# Determine the concentration of Cl- ions in seawater

## Aim To determine the concentration of chloride ions in sea water.

## Equipment

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| * eye protection * graduated flask, 100 cm3 * 2 beakers, 100 cm3 * 3 conical flasks, 100 or 250 cm3 | * burette and burette stand * white tile * pipette (10 ml) and safety filler * small filter funnel |

## Materials

* sea water
* potassium dichromate (VI) solution (usual bench concentration)
* 0.05 mol dm-3  silver nitrate solution (8.48g in 1 L)

##### Background information to the reactions involved

Every litre of sea water contains 35 g of dissolved salts, though the amounts vary according to the locality. Many different ions are present in sea water; the commonest cation is Na+ and the commonest anion is Cl- the concentration of which you are going to determine in this experiment.

The method used to detect Cl- ions is titration with silver nitrate solution of known concentration. Silver ions form insoluble silver chloride when added to a solution containing chloride ions:

Ag+ (aq) + Cl- (aq) ⎯→ AgCl (s)

By adding silver ions until silver chloride is no longer precipitated, the amount of chloride in a solution can be found. Potassium chromate(VI) can be used to indicate the end-point of the titration - the point at which all chloride ions have been precipitated. Silver ions combine with chromate ions to form a red precipitate of silver chromate (VI):

2Ag+ (aq) + CrO42- (aq) ⎯→ Ag2CrO4 (s)

When both chloride ions and chromate ions are present, however, no silver chromate is precipitated until all chloride ions are removed. The sudden appearance of red silver dichromate therefore indicates the end-point of the titration.

##### Procedure

Silver nitrate is expensive and is normally used in fairly low concentrations. In this titration you will use 0.05 M AgNO3 (aq). To obtain sensible results, it is therefore first necessary to dilute the sea water ten-fold to give a concentration of chloride ions comparable to that of the silver ions.

1. Pipette 10 ml of sea water into a 100 ml graduated flask.
2. Make up to the mark with distilled water, stopper the flask and mix thoroughly.
3. Pipette 10 ml of the diluted sea water into a conical flask and add about 10 drops of potassium chromate indicator.
4. Rinse a burette with a silver nitrate solution, then fill it with the solution.
5. Titrate the sea water in the conical flask against the silver nitrate solution from the burette until a reddish tinge just begins to appear.
6. You may the find the end-point a little difficult to detect so it is best to carry out a rough titration first and keep the result to remind you of the end-point colour when carrying out later accurate titrations.